Quasar Astrophysics with the Space Interferometry Mission

S. C. Unwin, A. E. Wehrle, D. L. Jones, D. L. Meier
Jet Propulsion Laboratory, California Institute of Technology

B. G. Piner
Whittier College

Abstract

SIM - the Space Interferometry Mission - will perform precision astometry on objects as faint as R magnitude 20. It will be the first space-based astrometric interferometer, operating in the optical band with a 10-m baseline. As a pointed rather than a survey instrument, SIM will maintain its astrometric accuracy down to the faintest magnitudes, opening up the opportunity for AGN and quasar astrometry to better than 0.01 milliarcseconds.

In its wide-angle mode, SIM will yield 4 microarcsecond absolute position and parallax measurements. The Science Team recently selected by NASA will observe with SIM to address a broad range of science questions: searches for low-mass planets - including analogs to our own solar system - the formation and dynamics of our Galaxy, calibration of the cosmic distance scale, and fundamental stellar astrophysics. The planet searches, and some of the AGN astrometry, will be done in a narrow-angle mode, with an accuracy of 4 microarcseconds or better, in a single measurement.

This talk will highlight one of the SIM Key Science projects: quasar astrophysics. There are 3 basic goals: (1) Does the most compact optical emission from an AGN come from an accretion disk or from a relativistic jet? (2) Do the relative positions of the radio core and optical photocenter of quasars used for the reference frame tie change on the timescales of their photometric variability, or is the separation stable? (3) Do the cores of galaxies harbor binary supermassive black holes remaining from galaxy mergers?

A variety of AGN phenomena are expected to be visible to SIM on microarcsecond scales, including time and spectral dependence in position offsets between accretion disk and jet emission. As well as absolute astrometry, SIM can measure position shifts as a function of color. This is a very powerful technique, allowing us to study quasar structure on angular scales well below the nominal interferometer resolution.